Date: February 27, 2009 | Category: Stars - Individual, Binaries, Clusters | Proposal: 2214

National Research Council of Canada, Herzberg Institute of Astrophysics
DAO 1.8-m TELESCOPE OBSERVING TIME REQUEST
Quarter: 2009B

1. Title of the Program *(may be made publicly available for accepted proposals)*:

The Plaskett Spectroscopic Supernova Survey: Real Time Classification and Spectral Library Acquisition

2. Principal Investigator: **Melissa Graham**

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3. Co-Investigators:

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Sarah Sadavoy	Institute: University of Victoria	E-mail: ssadavoy@uvic.ca

4. Summary of the Program *(may be made publicly available for accepted proposals)*:

The goals of the proposed program are to acquire spectroscopic confirmation and typing of newly discovered supernovae, and to compile a library of evolving supernova spectra.

5. Summary of the Observing Run Requested:

Instrument	Detector	Filters and/or Central Wavelengths
Spectrograph: 21(3/2)1	SITe5 - spec.	5500 Angstroms

# of nights	Robotic/Contract?	Moon (d)	Opt. LST at 0:00 HST	Min. LST at 0:00 HST	Max. LST at 0:00 HST
21	NO	10	Any	Any	Any

6a. Is this a Thesis Project? YES 6b. If yes, indicate supervisor: Dr. Chris Pritchet

7. Special instrument or telescope requirements:

2 arcsecond slit width

8. Scheduling constraints and non-usable dates:

The observing nights, preferably during dark time, should be as evenly spread out throughout the quarter as possible (e.g., seven three-night-runs) to ensure good temporal coverage.

9. Is this program conducted in relation with other observations (optical, radio, space)?

NO

10. Scientific Justification and References *(science background and objectives of the proposed observations: 1 page maximum)*:

Supernovae play an important role in shaping our universe. They are the main mechanism for creating heavy elements, the main source of neutrinos beyond the Big Bang, markers of dust properties and the star formation history of external galaxies, and currently the most powerful tool available for studying the expansion history of the universe and the nature of dark energy. These studies depend critically on the observations of nearby supernovae. The goals of the proposed observations are to spectroscopically confirm and type nearby supernovae and to make time series spectroscopic observations of these supernovae. On a given night there are 10 to 20 nearby supernovae at bright enough phases to be observed by the Plaskett telescope, some of which will require spectroscopic typing.

Type Ia supernovae are distinguished from core collapse supernovae by the presence of Si II lines and the absence of hydrogen and helium in their spectra. Type II supernovae are identified by their characteristic broad $H\alpha$ P Cygni profiles. The Plaskett Spectroscopic Supernova Survey began in the quarter of 2007C. So far, the survey has spectroscopically classified 13 supernovae. The properties of a supernova evolve on a timescale of days as the supernova expands after the explosion. Time series spectroscopic observations therefore provide valuable diagnostics from different layers of the supernova as the photosphere recedes toward the core. The survey has so far obtained 40 spectra. A subsample of the spectra is presented in Figure 1.

Supernova 2008fz exemplifies the value in time series observations of SN explosions. On 23 September 2008, PSSS found SN 2008fz showing a featureless, early SN Ic-like spectrum. After sixteen days, on 9 October 2008, an Italian team found this later time spectrum of SN 2008fz consistent with both a type IIn and the spectra of SN 2005gj and SN 2002ic (Benetti et al. 2008) which were shown to be hybrids between type Ia and type IIn (Hamuy et al. 2003; Aldering et al. 2006). The spectral fit of Benetti et al. (2008) was suspicious as it requires a redshift of z=0.133, making SN 2008fz one of the most luminous core collapse events ever witnessed and placing it well beyond the PSSS's usual maximum redshift of z=0.04.

The emergence of new subclasses of type Ia supernovae from such controversial observations reflects our lack of physical understanding and offers new insights to the nature of these objects. As a second example, preliminary analysis of the spectrum of SN 2008A (Figure 1) showed it to be similar to the spectrum of peculiar type Ia SN 2005hk (Phillips et al. 2007) at a few weeks past maximum light. Both supernovae have narrow features near the Si II 6355Å line and unusually slow expansion velocities compared to a normal type Ia (e.g., SN 2007fb in Figure 1). The characteristic narrow features are possibly from partially burnt material, supporting the scenario of a pure deflagration explosion.

Upcoming sky surveys such as Pan-STARRS and LSST will discover thousands of supernovae at intermediate and high redshifts, where spectral classification is more difficult. Low redshift programs will remain essential for identifying new subclasses of supernovae and determining their relative populations, and this is how the PSSS will continue to contribute to modern supernova studies. The most up-to-date information on the survey, such as the target list, observing log and publications, is located on our website at: http://www.astro.uvic.ca/~hsiao/psss/

References:

Aldering, G. et al. 2006, ApJ, 650, 510
Bennetti, S. et al. 2008, CBET 1533
Hamuy, M. et al. 2003, Nature, 424, 651
Phillips, M. M. et al. 2007, PASP, 119, 360

11. Figures *(all figures must appear on a single page)*:

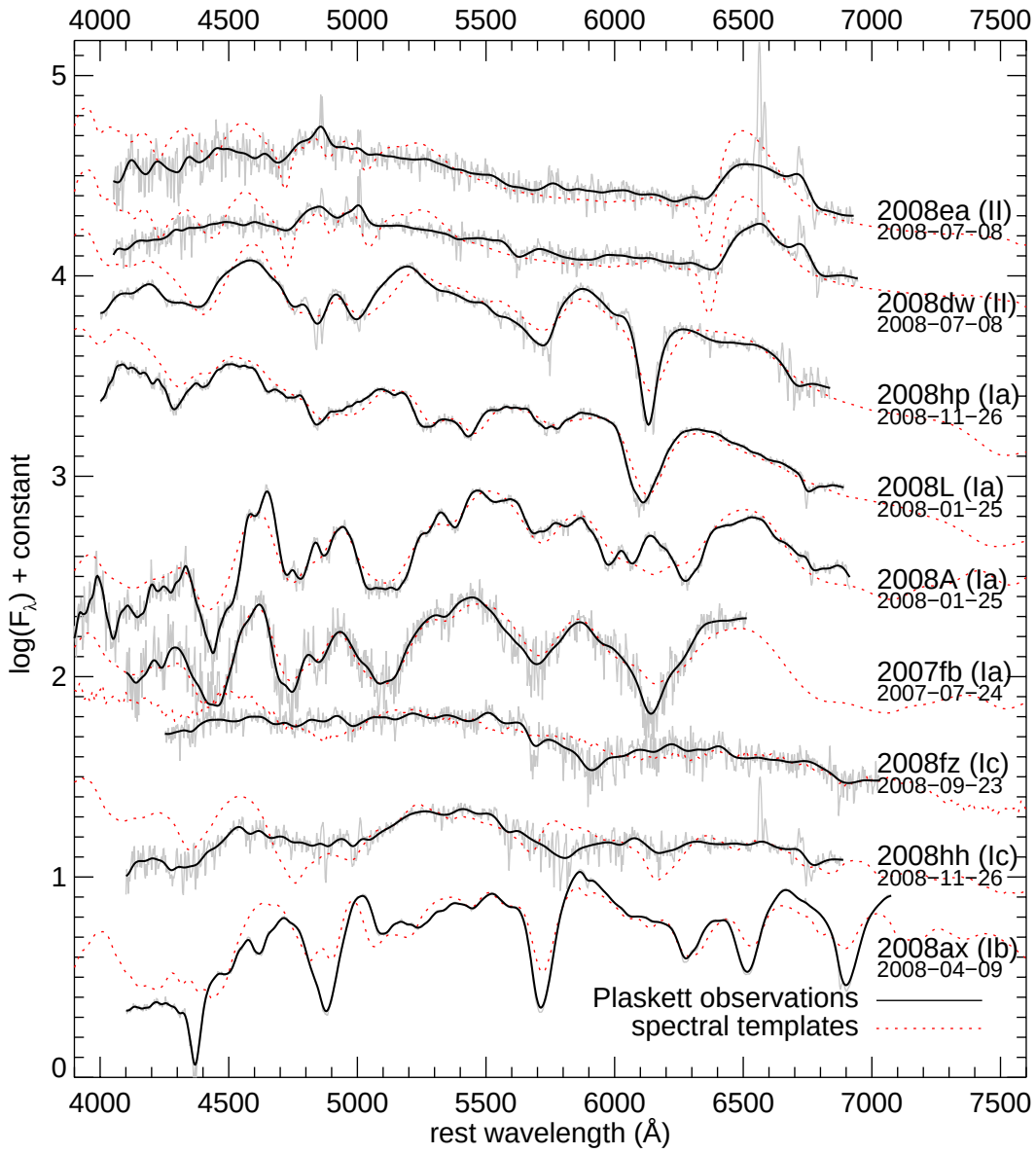

Figure 1: A subsample of the supernova spectra acquired by the Plaskett Spectroscopic Supernova Survey. The spectra have been dereshifted to the rest frame using the redshifts of the host galaxies. The observed spectra (solid curves) are compared with spectral templates (dotted curves) at the best fitting phases. Smoothed observed spectra are plotted to aid the comparisons. Observed dates and supernova types are also noted.

12. Targets:

Object/Field	α	δ	Epoch	Mag/Flux	Comment

13. General Target Information:

As supernovae are transient, targets will be selected from available sources of newly discovered supernovae on a nightly basis. On a given night, three to four supernovae are observed from a target list of 10 to 20 supernovae. The current target list is located on our website at: http://www.astro.uvic.ca/~hsiao/psss/targets/.

14. Publications Resulting from DAO Observations *(only the 12 most recent contained in the database are displayed)*:

Hsiao, E. Y., Graham, M. L., Pritchet, C. J. & Balam, D. 2008, CBET, 1219, 1
Hsiao, E. Y., Graham, M. L., Pritchet, C. J. & Balam, D. 2008, CBET, 1224, 1
Hsiao, E. Y., Graham, M. L., Pritchet, C. J. & Balam, D. 2008, CBET, 1267, 1
Hsiao, E. Y., Graham, M. L., Pritchet, C. J. & Balam, D. 2008, CBET, 1429, 1
Hsiao, E. Y., Graham, M. L., Pritchet, C. J. & Balam, D. 2008, CBET, 1434, 1
Hsiao, E. Y., Graham, M. L., Pritchet, C. J. & Balam, D. 2008, CBET, 1436, 1
Hsiao, E. Y., Graham, M. L., Pritchet, C. J. & Balam, D. 2008, CBET, 1502, 1
Hsiao, E. Y., Graham, M. L., Pritchet, C. J. & Balam, D. 2008, CBET, 1524, 1
Hsiao, E. Y., Graham, M. L., Pritchet, C. J., Parker, A., Sadavoy, S. & Balam, D. 2008, CBET, 1547, 1
Hsiao, E. Y., Graham, M. L., Pritchet, C. J. & Balam, D. 2008, CBET, 1512, 1
Yamaoka, H., Itagaki, K., Nakano, S., Nevski, V., Hsiao, E. Y., Graham, M. L., Pritchet, C. J., Balam, D. & Kazarovets, E. 2008, IAU Circ., 8989, 1
Hsiao, E. Y., Graham, M. L., Pritchet, C. J., Parker, A., Sadavoy, S. & Balam, D. 2008, CBET, 1551, 1

Disclaimer: *In submitting this application, I acknowledge that I am aware of DAO's policy concerning public access to data after a proprietary period of one year.*

Signature: signed via "POOPSY"